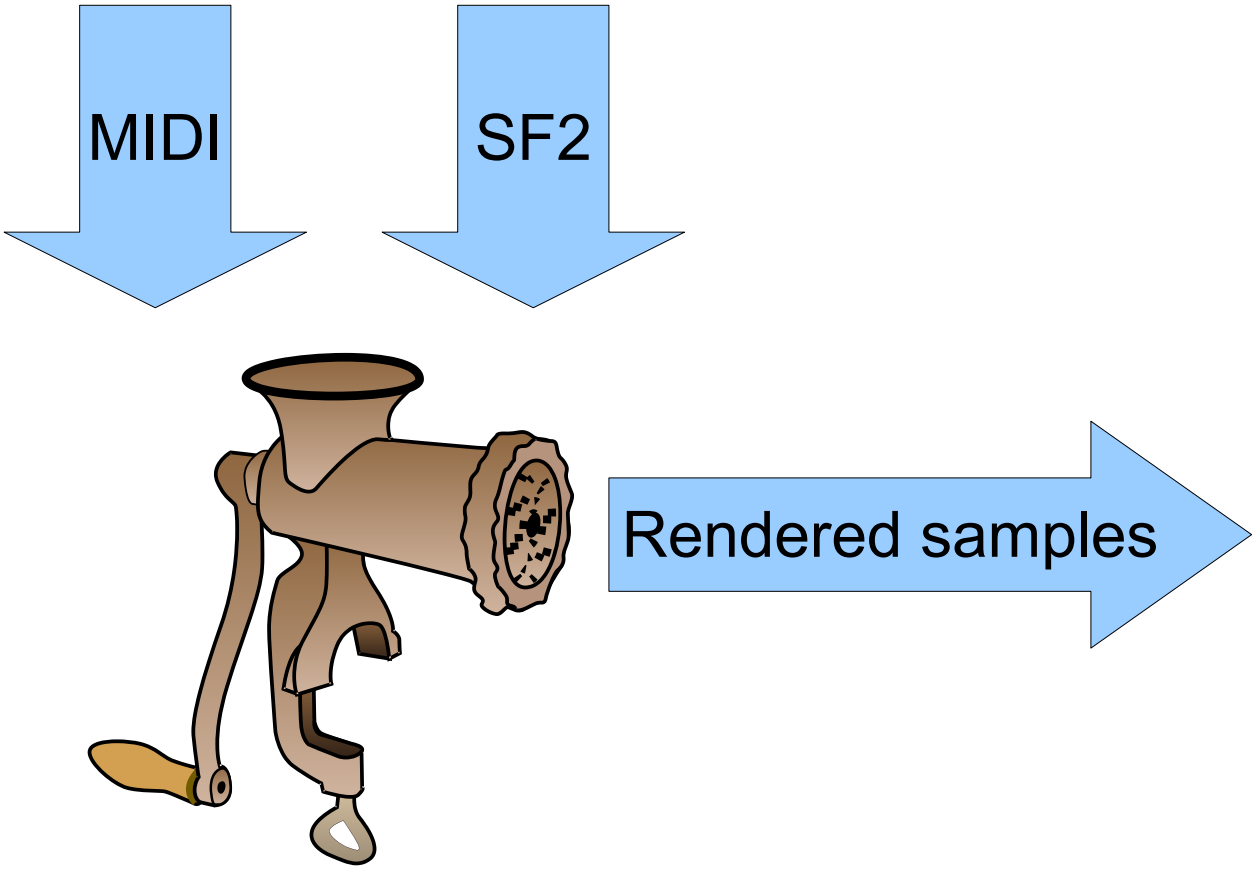
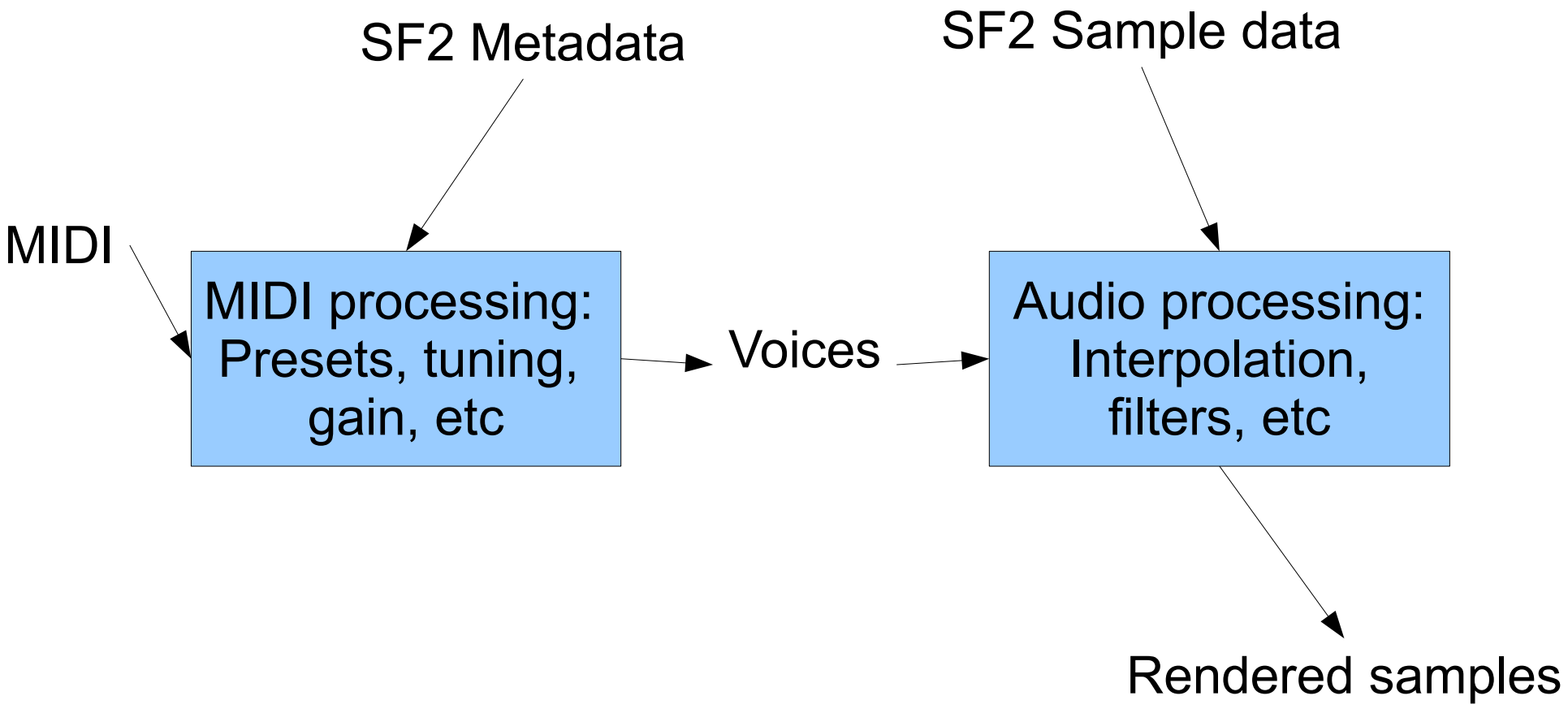
Hey, it's yet another slideshow!

(how surprising!)

FluidSynth overview



How FluidSynth works



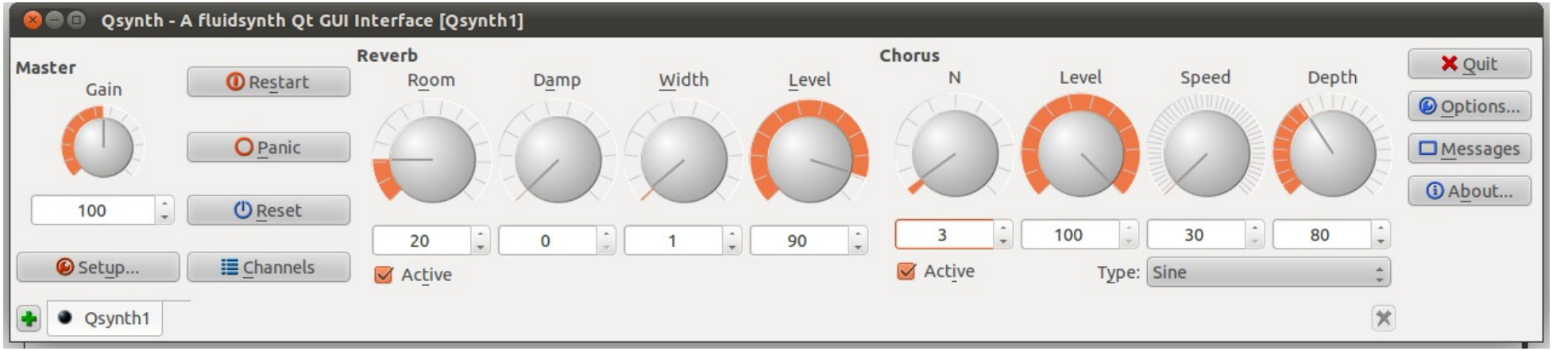
Use cases

- Live playing
- MIDI file player
- MIDI file renderer

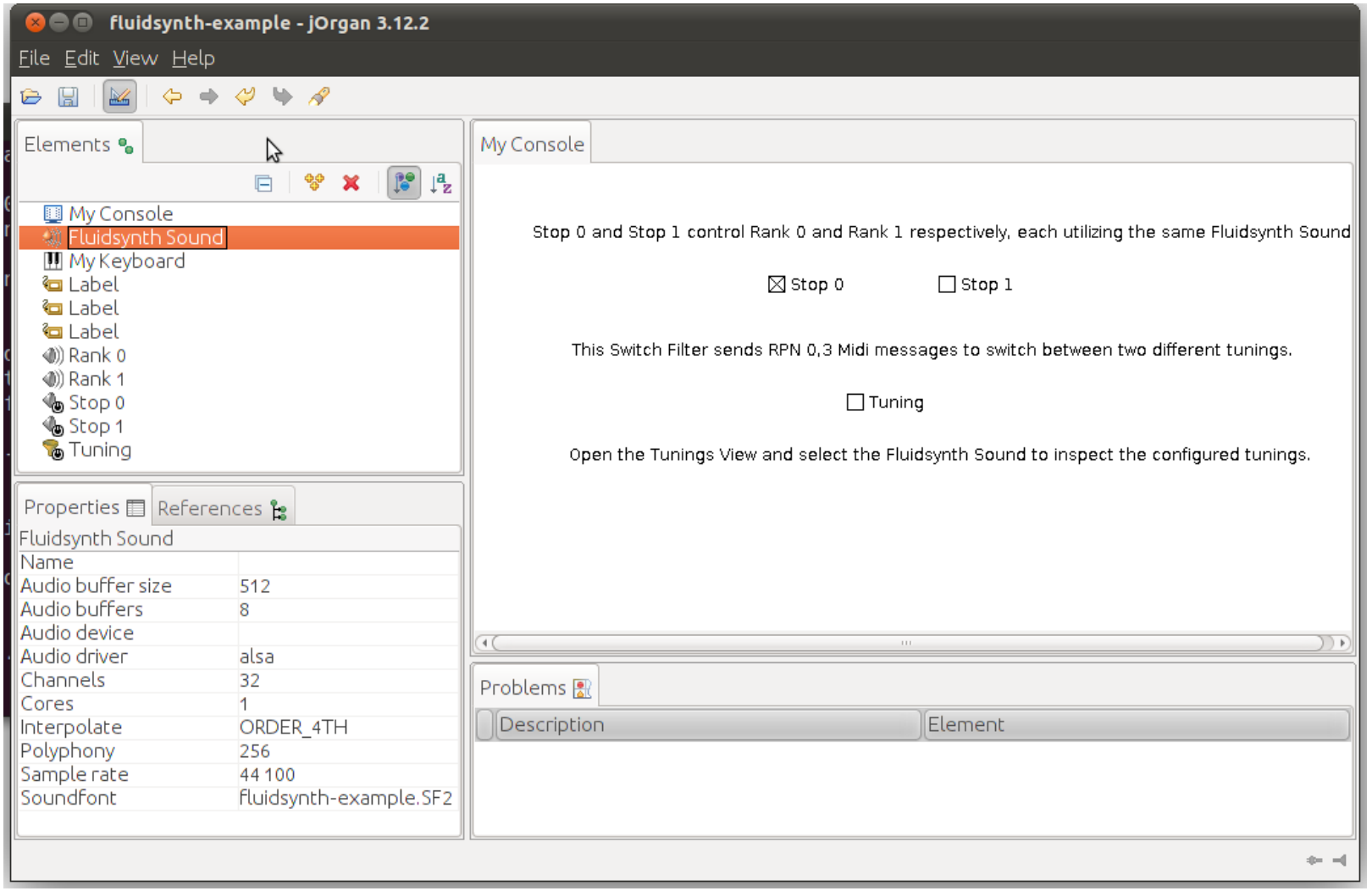
  ...but mostly:

- Embedded as an engine in other applications

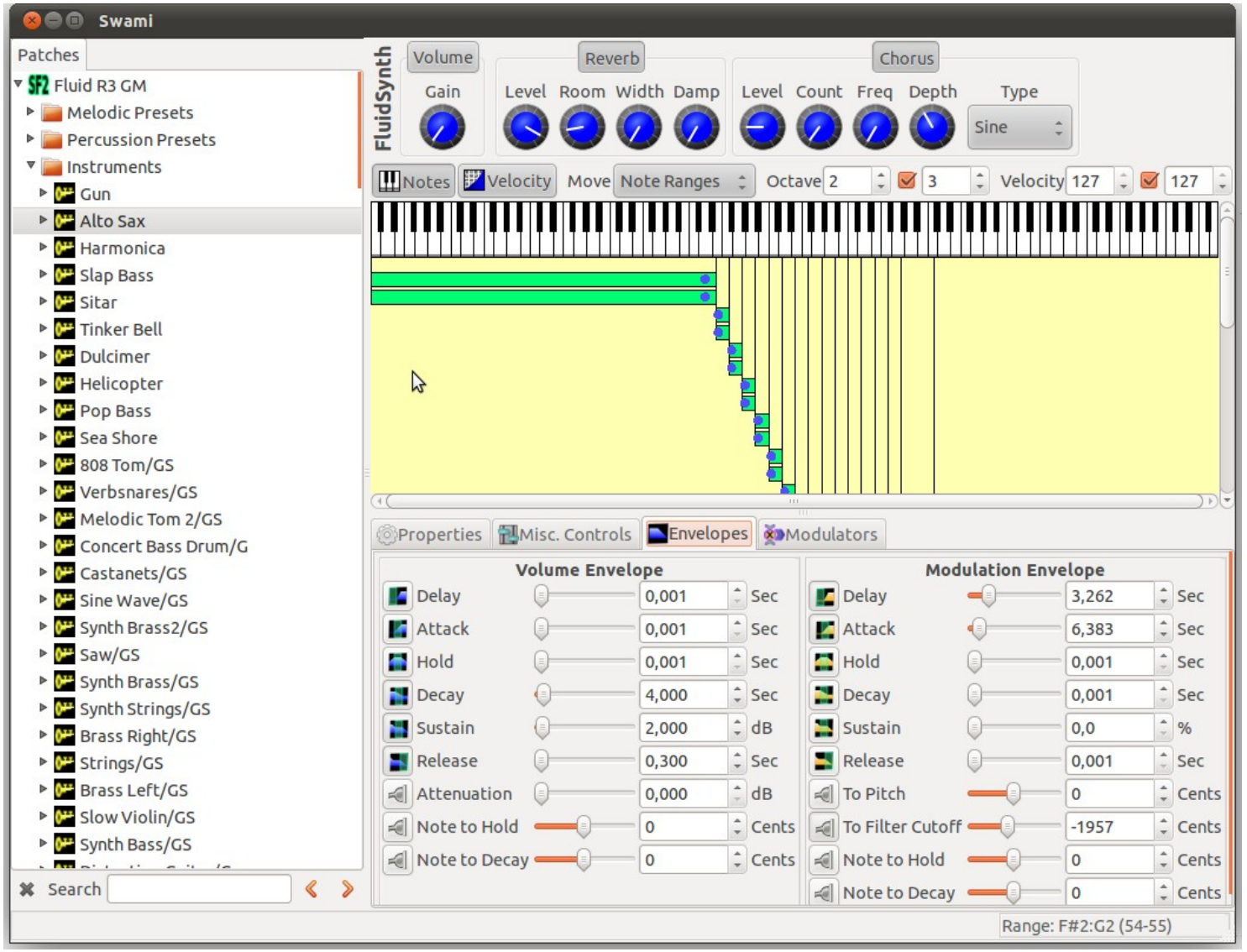
QSynth


Qsynth - A fluidsynth Qt GUI Interface [Qsynth1]
Master
Gain
100
Restart
Panic
Reset
Setup...
Channels
Reverb
Room
Damp
Width
Level
20
0
1
90
Active
Chorus
N
Level
Speed
Depth
3
100
30
80
Active
Type:
Sine
Quit
Options...
Messages
About...
Qsynth1

jOrgan


fluidsynth-example - jOrgan 3.12.2
File Edit View Help
Elements
My Console
Fluidsynth Sound
My Keyboard
Label
Label
Label
Rank 0
Rank 1
Stop 0
Stop 1
Tuning
Properties
References
Fluidsynth Sound
Name
Audio buffer size 512
Audio buffers 8
Audio device
Audio driver alsa
Channels 32
Cores 1
Interpolate ORDER_4TH
Polyphony 256
Sample rate 44 100
Soundfont fluidsynth-example.SF2
My Console
Stop 0 and Stop 1 control Rank 0 and Rank 1 respectively, each utilizing the same Fluidsynth Sound
Stop 0
Stop 1
This Switch Filter sends RPN 0,3 Midi messages to switch between two different tunings.
Tuning
Open the Tunings View and select the Fluidsynth Sound to inspect the configured tunings.
Problems
Description
Element

SWAMI


Swami
Patches
Fluid R3 GM
Melodic Presets
Percussion Presets
Instruments
Gun
Alto Sax
Harmonica
Slap Bass
Sitar
Tinker Bell
Dulcimer
Helicopter
Pop Bass
Sea Shore
808 Tom/GS
Verbsnares/GS
Melodic Tom 2/GS
Concert Bass Drum/G
Castanets/GS
Sine Wave/GS
Synth Brass2/GS
Saw/GS
Synth Brass/GS
Synth Strings/GS
Brass Right/GS
Strings/GS
Brass Left/GS
Slow Violin/GS
Synth Bass/GS
Search
FluidSynth
Volume
Gain
Reverb
Level Room Width Damp
Chorus
Level Count Freq Depth
Type
Sine
Notes
Velocity
Move
Note Ranges
Octave 2
3
Velocity 127
127
Properties
Misc. Controls
Envelopes
Modulators
Volume Envelope
Delay 0,001 Sec
Attack 0,001 Sec
Hold 0,001 Sec
Decay 4,000 Sec
Sustain 2,000 dB
Release 0,300 Sec
Attenuation 0,000 dB
Note to Hold 0 Cents
Note to Decay 0 Cents
Modulation Envelope
Delay 3,262 Sec
Attack 6,383 Sec
Hold 0,001 Sec
Decay 0,001 Sec
Sustain 0,0 %
Release 0,001 Sec
To Pitch 0 Cents
To Filter Cutoff -1957 Cents
Note to Hold 0 Cents
Note to Decay 0 Cents
Range: F#2:G2 (54-55)

Use cases and requirements

- Live playing
- MIDI file player
- MIDI file renderer

...but mostly:

- Embedded as an engine in other applications

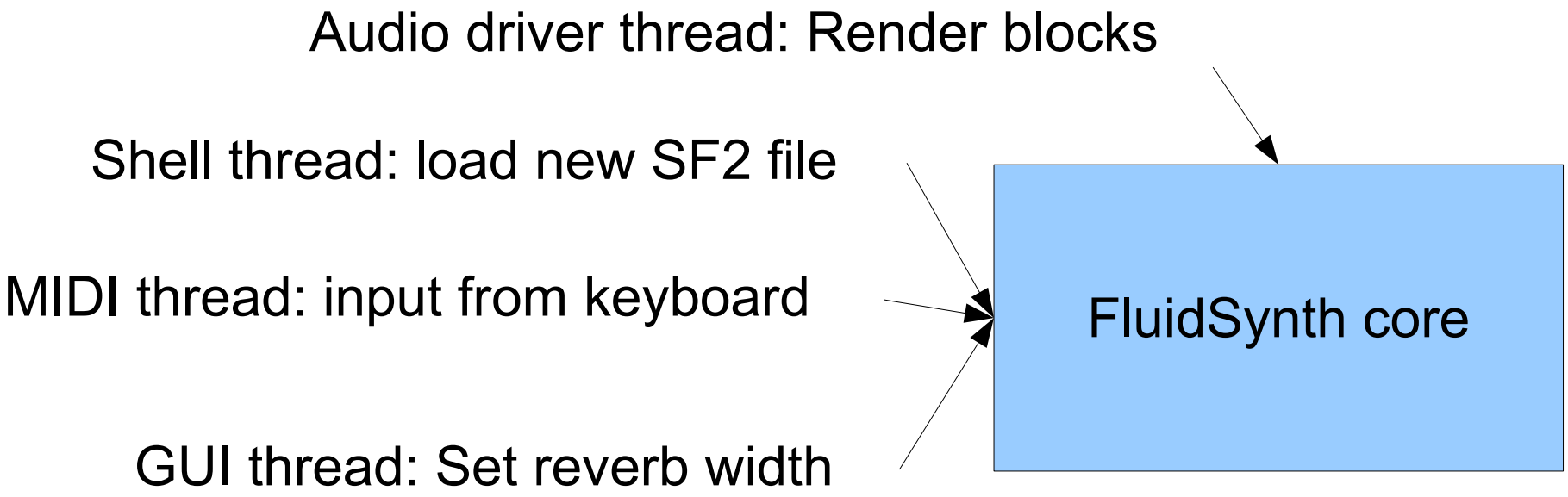
- Low latency
- High performance
- Introspection
- Configurability

The impossible problem

1. Load a soundfont from disk
2. Select a preset
3. Start a note
4. Render a block of audio

And...be done within half a millisecond, or we'll get an underrun!

Threads


Audio driver thread: Render blocks
Shell thread: load new SF2 file
MIDI thread: input from keyboard
GUI thread: Set reverb width
FluidSynth core

How we did it before 1.1.0

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Okay, that was a little mean, but...

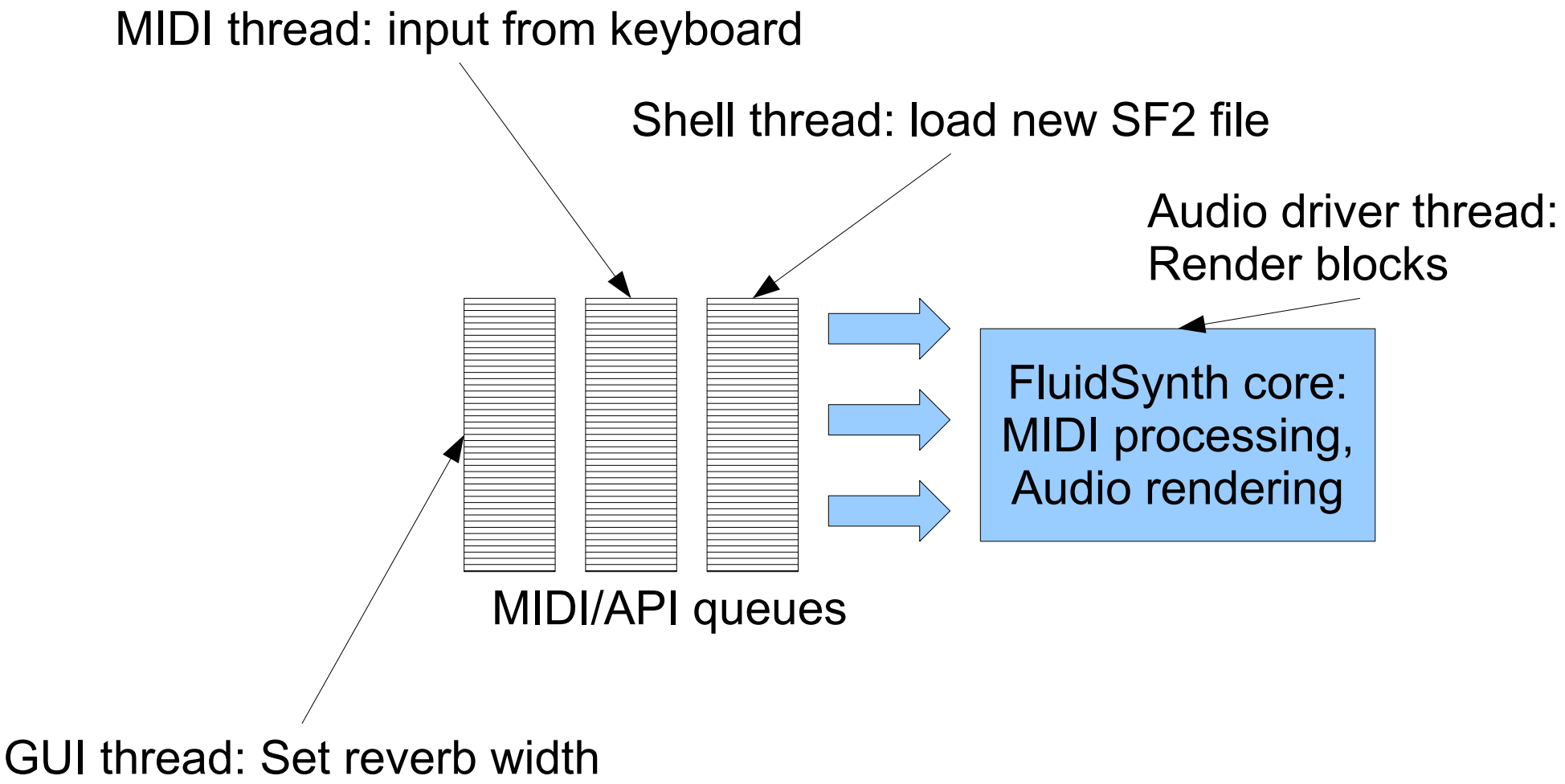
```
int fluid_synth_noteoff(fluid_synth_t* synth, int
chan, int key)
{
  int i;
  int status = FLUID_FAILED;
/*   fluid_mutex_lock(synth->busy); /\* Don't
       interfere with the audio thread *\/ */
/*   fluid_mutex_unlock(synth->busy); */

  for (i = 0; i < synth->polyphony; i++) {
...
```

Timing sources

- The system timer
  - Based on the CPU's system clock
  - *Problem 1*: Slow rendering
  - *Problem 2*: Worse timing with large buffer sizes – AKA the ”drunk drummer”
- The sample timer
  - Based on written audio data
  - *Problem*: signaling / communication

1.1.0 architecture



We were doing great, until...

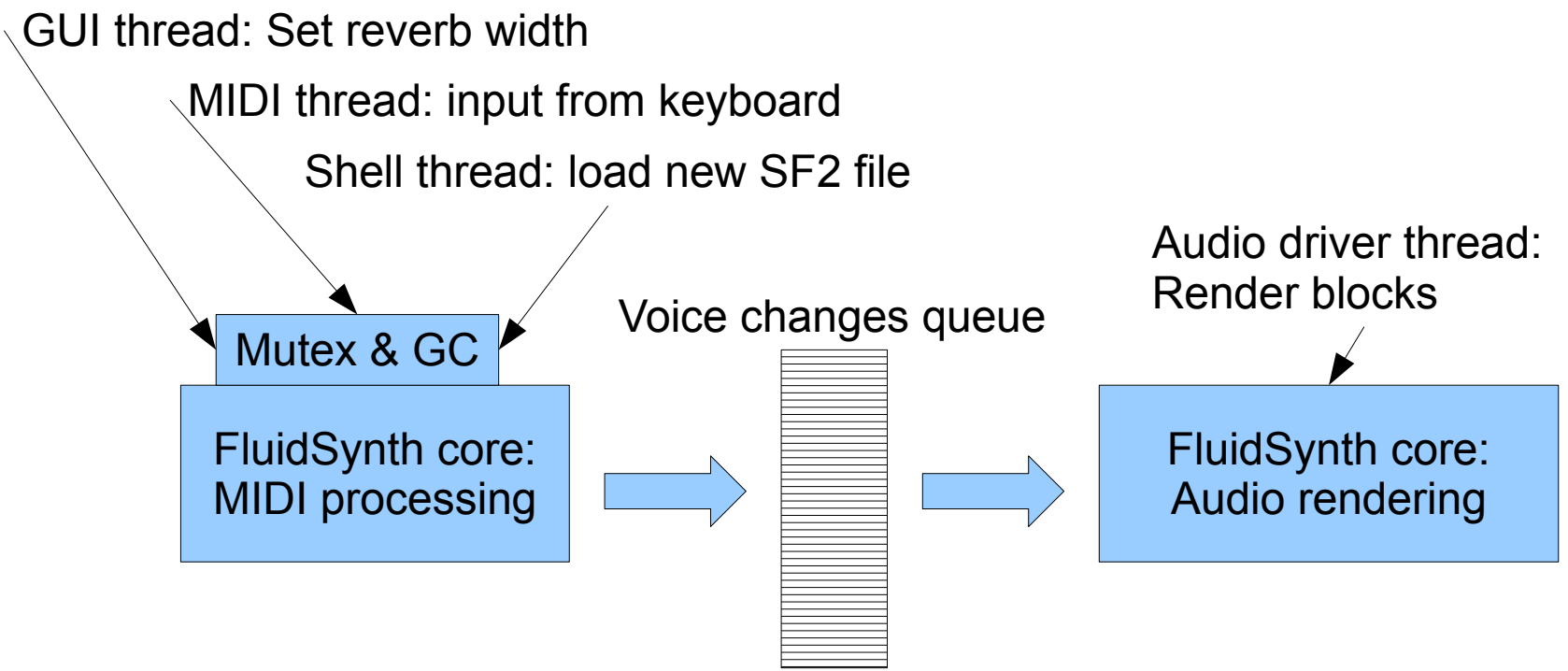
From: Rui Nuno Capela

houston, we have a problem.
i am sorry to chime in this late, but qsynth won't support this fluidsynth release.
/.../
qsynth behaves very badly, inconsistently and troublesome against 1.1.0.
everything just feels broken.

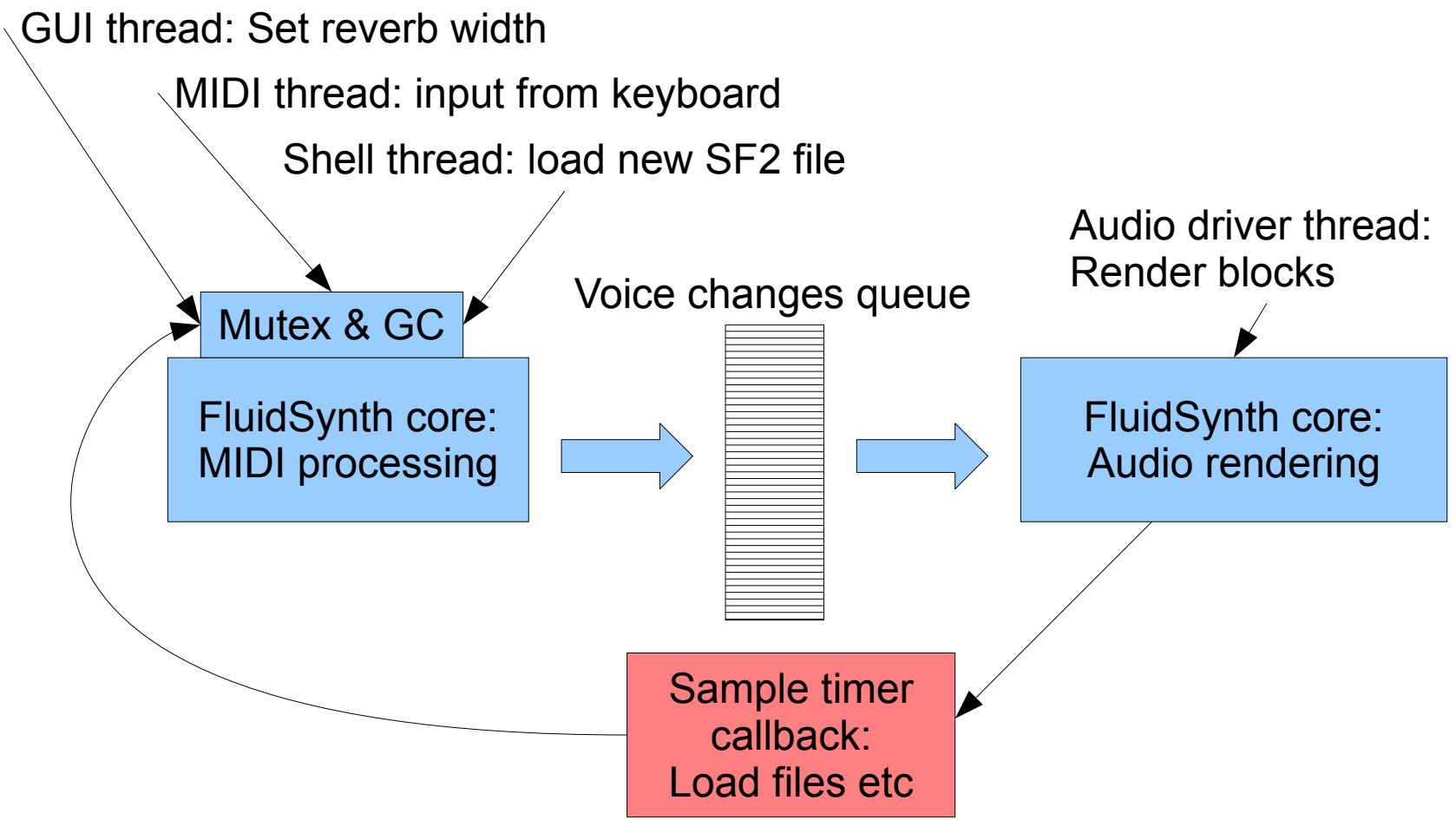
Problems with 1.1.0

- Not getting what you're setting
  - Workaround: atomic stuff
- More to do for the audio thread
  - Workaround: move time intensive stuff to before the queue
- Reordering issues
  - Partially because of the two previous workarounds

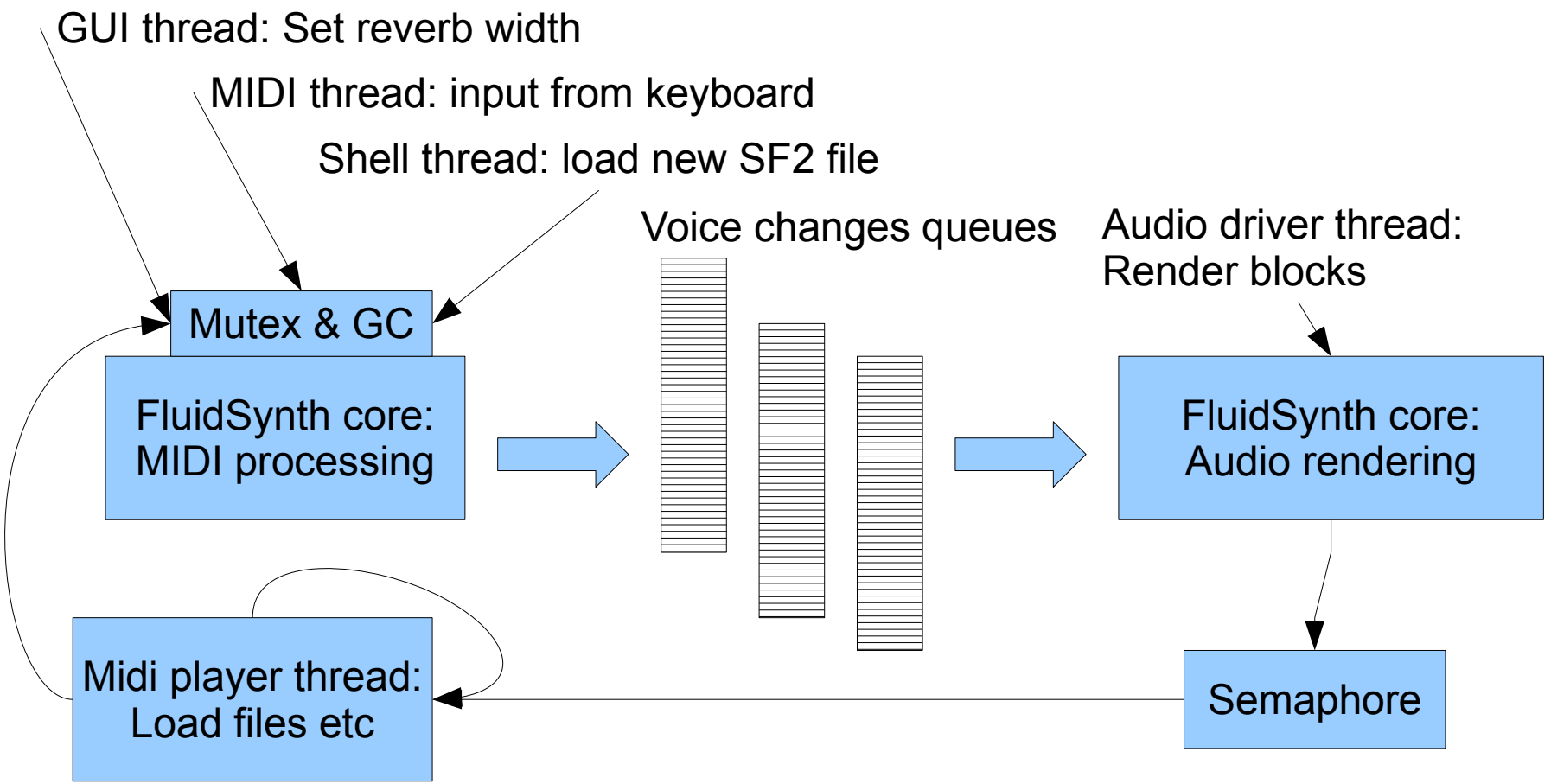
1.1.2 architecture



The sample timer problem



Sample timer: proposed solution



Synchronous MIDI and audio

- So far, JACK MIDI and JACK audio is the only known combination that causes this problem
- Solution could be to queue MIDI events to lower priority thread
  - ...unless we're ”freewheeling”

More introspection

- MIDI engine cannot know state of voices
- Wanted for voice overflow situations
- Wanted for some editors and players
  - Could be solved by audio thread writing down state data after every block, then atomically exchanging pointers

Questions?

Ask them now or forever email
fluid-dev@nongnu-org